

## **Chapter 2:**

### **Program Management Instructions**

#### **2.1 -- Program WBS Attributes**

The Program WBS is intended to achieve a clear understanding and statement of the technical objectives and the end item(s) or end product(s) of the work to be performed.

In order to use the work breakdown structure as a framework for the technical objectives of a program (in addition to its use as a management tool for cost and schedule control), the work breakdown structure must be product oriented. Its elements should represent identifiable work products whether they be equipment, data, or related service products. Because any work breakdown structure is a product structure, not an organization structure, complete definition of the effort encompasses the work to be performed by all participants.

#### **2.2 -- Preparing a Program WBS**

The program manager is responsible for maintaining the Program WBS as it develops through systems engineering and management planning processes. The work breakdown structure may span one or more of the categories or elements defined in Appendices A through G. While these elements normally provide a basis for the Program or Contract WBS, deviations may occur when a unique requirement exists which these appendices have not addressed. In addition, although each appendix relates to a specific category of defense items, any item from any appendix which is applicable to the program may be used, as long as the integrity of the level of placement is maintained.

##### **2.2.1 -- Developing a Program WBS**

The Program WBS should be developed early in the conceptual stages of the program. It evolves through iterative analysis of the program objective, functional design criteria, program scope, technical performance requirements, proposed methods of performance (including acquisition strategy, drawings, process flow charts), and other technical documentation. It is important that documentation describe the DoD plan to build, integrate, field, and support the system throughout its life cycle until it is removed from the inventory.

The Cost Analysis Requirements Document (CARD) will be the recording document for this program plan. Ultimately, the Program WBS is approved through the Contractor Cost Data Reporting (CCDR) plan process. In this process, the levels of reporting and elements for appropriate RFP selection are determined.

##### **2.2.2 -- Selecting Program WBS Elements**

The work breakdown structure provides a framework for specifying the technical objectives of the program by first defining the program in terms of hierarchically related, product-oriented

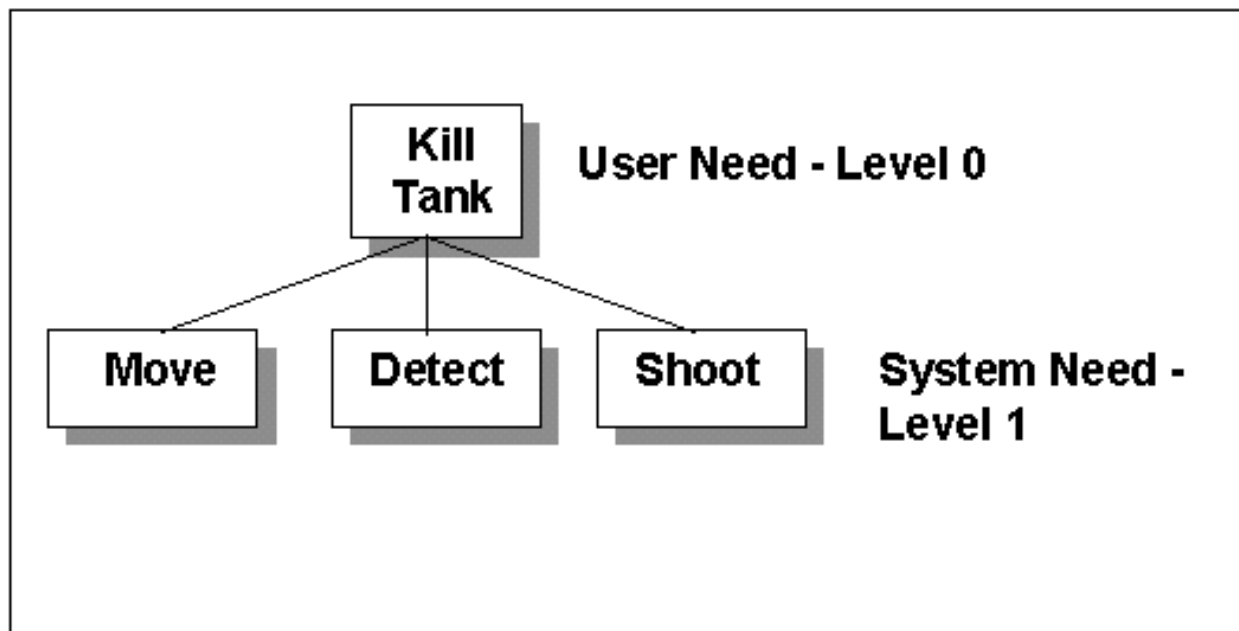
elements and the work processes required for their completion. Each element of the work breakdown structure provides logical summary points for assessing technical accomplishments and for measuring the cost and schedule performance accomplished in attaining the specified technical objectives.

### **2.2.3 -- Determining Levels of Program WBS**

For each work breakdown structure element, the detailed technical objectives are defined and specified work tasks are assigned to each contractor's organization elements, and assigned for the resources, materials, and processes required to attain the objectives. The linkage between the specification requirements, the work breakdown structure, the statement of work, and the master and detailed schedules provides specific insights into the relationship between cost, schedule, and performance. This relationship allows all items to be tracked to the same work breakdown structure element. Therefore, the levels of the Program WBS should be related to these requirements and conform to its product-oriented family tree.

When developing a Program WBS, the efforts of the systems engineers throughout the life cycle will aid in defining the description of the system and its related levels. Early in the Concept Exploration phase the systems engineering efforts are aimed at trying to establish the user's need. For example, suppose that need has been established as "Kill Tank." The objective is clear and can be met through numerous scenarios. The engineers perform tradeoffs for each scenario, and the preliminary system level functions are defined. In this case, the system that will "Kill Tank" must be able to maneuver to get into position, detect the tank by some means, and shoot. (See Figure 2-1.) The work breakdown structure is not formed around these functional requirements, but is developed out of the products which are considered to meet these requirements. Therefore, during the Concept Exploration phase, no formal work breakdown structure is defined.

## Concept Exploration



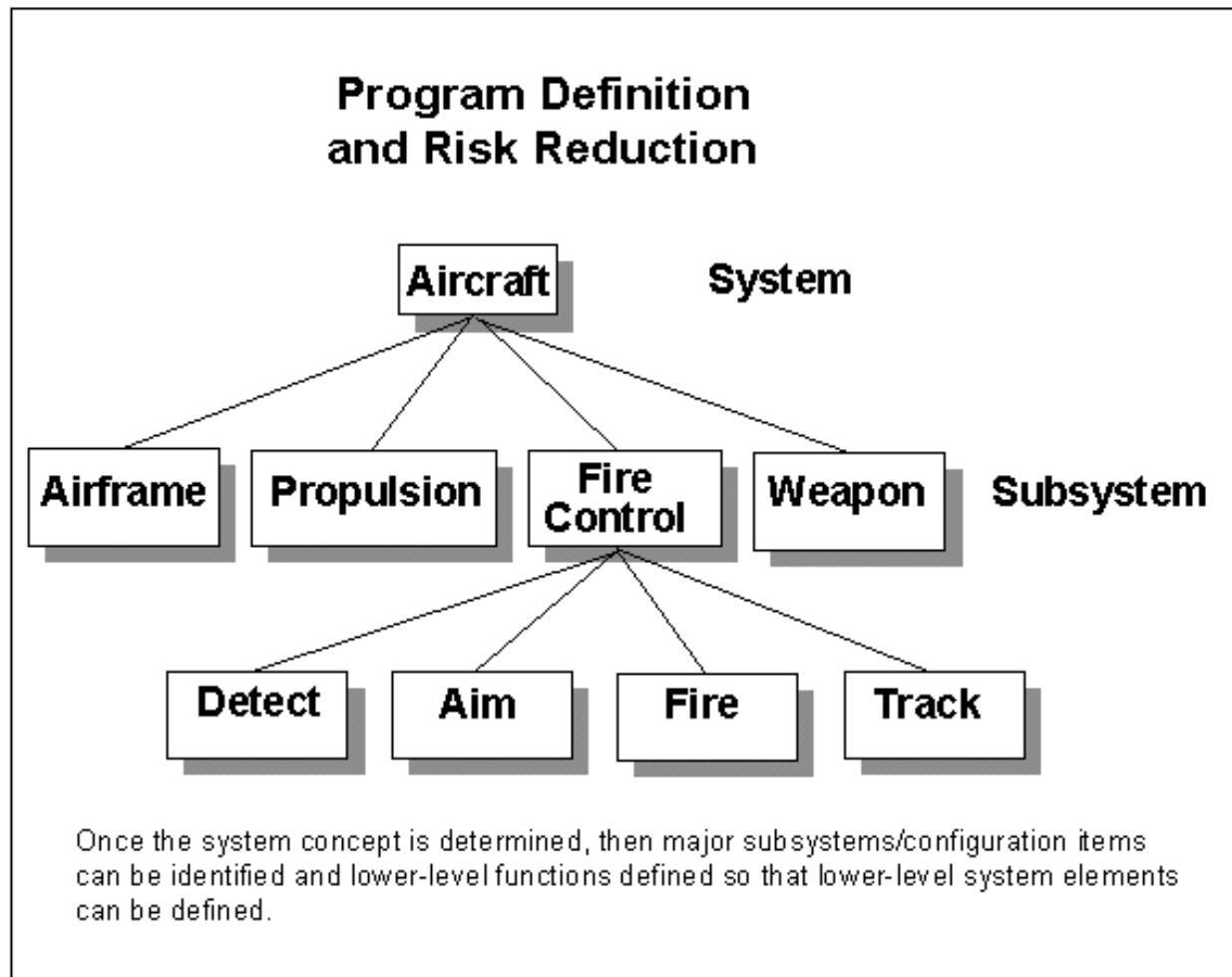
*Figure 2-1: -- Functional Requirements in the Concept Exploration Phase*

When the Program Definition and Risk Reduction phase is initiated, an Operational Requirements Document is published. This is one of the first documents which shows that the program is approved. With that approval the systems engineering efforts will focus on system level performance requirements, specifically proving critical technologies and processes, and developing top level specifications. Configuration items are assigned under a functional architecture all meeting the mission need of “Kill Tank.” If government laboratories or in-house engineering support is accomplishing this work, a contractual statement of work may be prepared for formal request for proposal release in the Engineering and Manufacturing Development phase. Otherwise, this may have already been accomplished at the end of Concept Exploration to obtain contractual support for the Program Definition and Risk Reduction phase.

The work breakdown structure is better defined at this point. Before release of a formal request for proposal, the government identifies the work breakdown structure for the program and contract efforts and must approve a Contractor Cost Data Reporting plan. It is at this time that the preliminary Program WBS will be defined to level 3.

The Program Definition and Risk Reduction phase should describe the system in terms of its specifications and the configuration items that make up the system. Once the system concept is determined, then major subsystems and configuration items can be identified and lower level functions defined, so that lower level system elements can be defined. Again these are not work breakdown structure elements since they do not reflect a product. In this example, using a cost effectiveness tradeoff process determined that the fire control system of an aircraft can meet the

mission need. The fire control system is functionally able to detect, aim, track, and fire. (See Figure 2-2.)



*Figure 2-2: -- Identification of Major Subsystems and Configuration Items*

The relationship of the functions shown in the previous example can now be translated into products that will meet the mission need requirement. The result is a program work breakdown structure defined to level 3. Generically, the work breakdown structure is defining the solution to the problem in terms of a product (See Figure 2-3). This figure shows the hierarchical relationship of the Aircraft System to the Fire Control Subsystem and other elements. When Program Definition and Risk Reduction units are being developed and produced, the Program WBS should be approved by submitting a Contractor Cost Data Reporting plan, as is currently required by DoD Regulation 5000.2-R. The plan describes the Program WBS being used and defines the approach the government activity plans to use for collecting cost data.

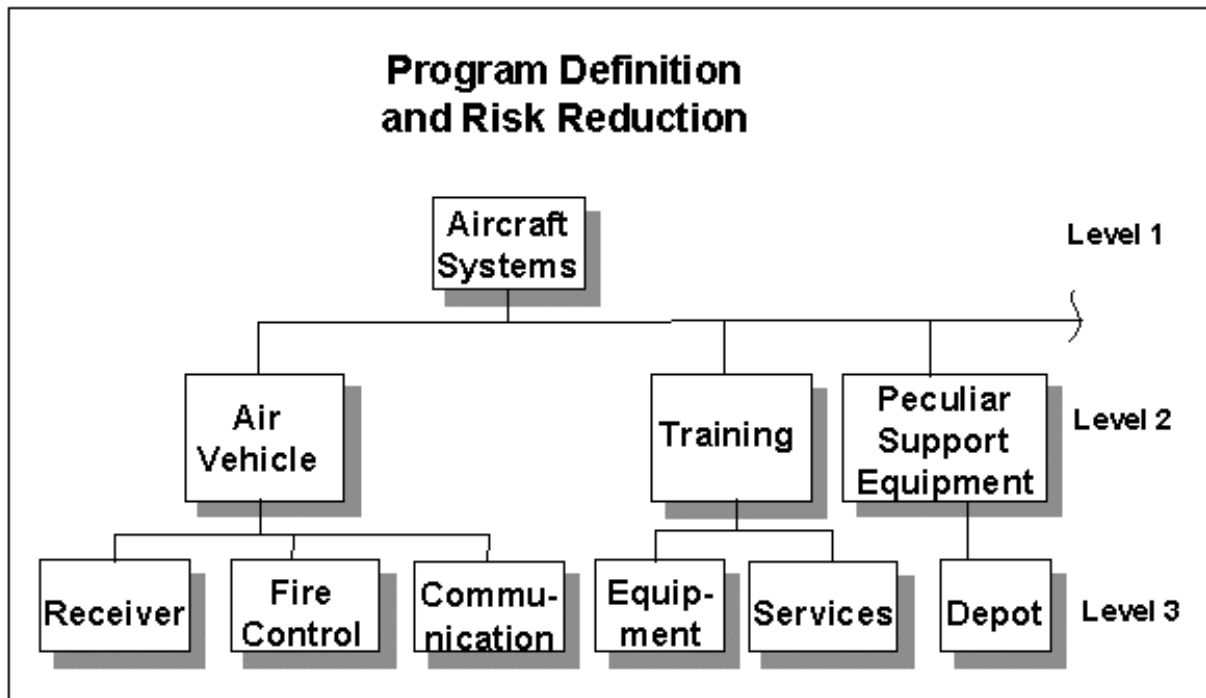


Figure 2-3: -- Program WBS Description

During the Engineering and Manufacturing Development phase of the program, systems engineering efforts include updating the Operational Requirements Document and defining the system configuration to its lowest level. Detailed design activities are ongoing, and by the end of this phase the total system definition is complete. The government has approved the Program WBS and each Contract WBS. As the system becomes better defined, the contractor extends the Contract WBS to the level and form reflecting the way business is planned and managed. The levels of the work breakdown structure are directly linked with the detailed configuration of the system.

Now that the system has been defined, the relationship of the Program WBS to the Contract WBS can be shown. The example assumes that the government activity is responsible for the FX Aircraft System. As a result, a contract must be awarded for the fire control system. Figure 2-4 depicts this relationship. If the FX Aircraft were awarded as a contract to a prime contractor, one could also assume that this is a Prime/Subcontract relationship. Replacing the words “Program” and “Contract” with “Prime” and “Subcontractor” respectively, the flowdown to the work breakdown structure requirement can be shown. In this case the Program WBS could be both the Program and the Contract WBS. The relationships are still the same; the difference is in how they relate to the government activity.

During the production phase of the program, the system is produced as defined throughout the previous phases. Production usually includes the actual fabrication, modification, purchase, or some combination thereof, of hardware/software/firmware. The systems engineering efforts are actively involved in maintaining the configuration of the system being produced. The work breakdown structure is defined to the level appropriate for contract management and

maintenance. When major modifications occur, the same WBS can be used; or, if the changes are substantial, a new work breakdown structure can be developed according to the same rules identified.

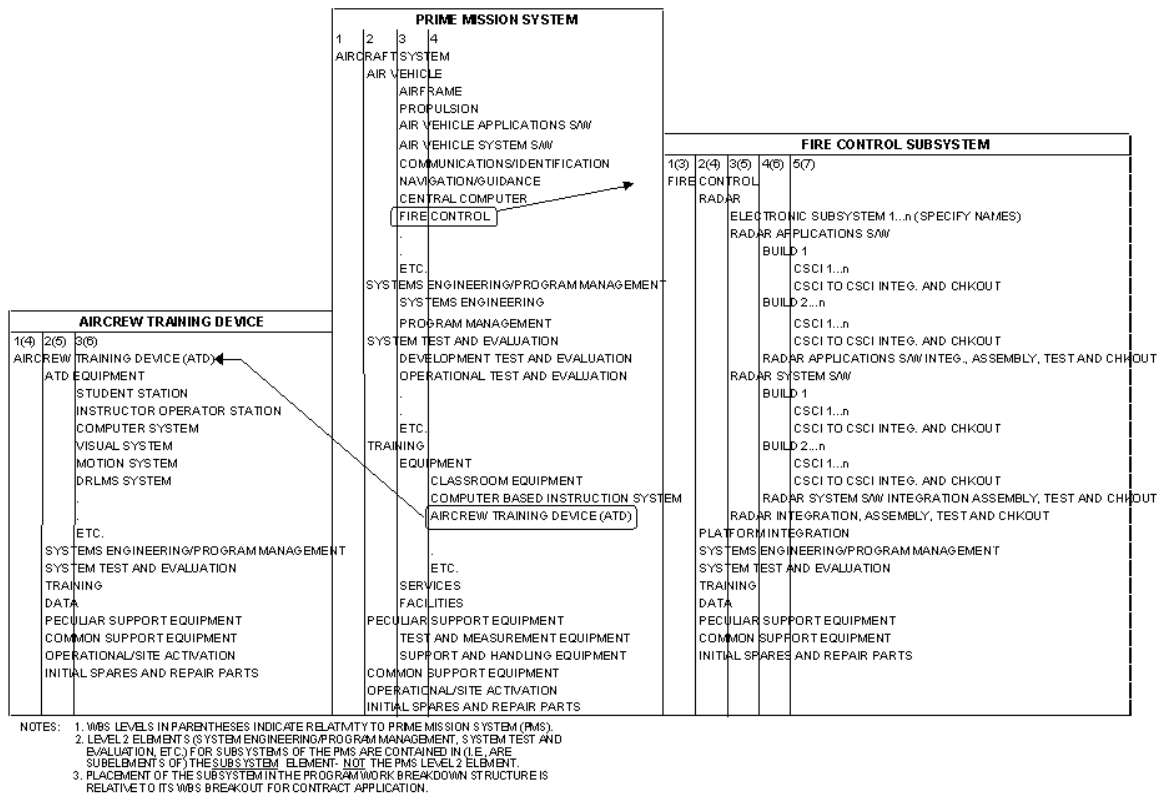


Figure 2-4: -- Work Breakdown Structure Matrix (Contract WBS)

## 2.2.4 -- Creating The WBS Dictionary

As part of developing a Program WBS, the program manager will also develop a WBS Dictionary. The dictionary lists and defines the work breakdown structure elements. Although initially prepared by the Government Program Manager, the dictionary is expanded by the contractor as the Contract WBS is developed. The initial WBS Dictionary should be based on the generic definitions in this handbook, made program specific to define the products being acquired.

The dictionary shows the hierarchical relationship of the elements and describes each work breakdown structure element and the resources and processes required to produce it. It also provides a link to the detailed technical definition documents. The work breakdown structure dictionary should be routinely revised to incorporate changes and should reflect the current status of the program throughout the program's life.

### 2.2.5 -- Avoiding Pitfalls in Constructing a Work Breakdown Structure

A sound work breakdown structure clearly describes what the program manager wants to acquire. It has a logical structure and is tailored to a particular defense materiel item. It can tie the statement of work, CLIN structure, and the system description documents together. Remember: the work breakdown structure is product oriented. It addresses the products required, NOT the functions or costs associated with those products.

#### ***Elements not to include***

The following paragraphs expand the explanation of what elements are to be excluded from the WBS elements:

***Do not include elements which are not products.*** A signal processor, for example, is clearly a product, as are mock-ups and Computer Software Configuration Items (CSCIs). On the other hand, things like design engineering, requirements analysis, test engineering, aluminum stock, and direct costs, are not products. Design engineering, test engineering, and requirements analysis are all engineering functional efforts; aluminum is a material resource; and direct cost is an accounting classification. Thus none of these elements are appropriate work breakdown structure elements.

***Program phases*** (e.g., design, development, production, and types of funds, or research, development, test and evaluation) are inappropriate ***as elements in a work breakdown structure.***

***Rework, retesting and refurbishing are not separate elements in a work breakdown structure.*** They should be treated as part of the appropriate work breakdown structure element affected.

***Non-recurring and recurring classifications are not work breakdown structure elements.*** The reporting requirements of the CCDR will segregate each element into its recurring and non-recurring parts.

***Cost saving efforts such as total quality management initiatives, could cost, and warranty are not part of the work breakdown structure.*** These efforts should be included in the cost of the item they affect, not captured separately.

***Do not use the structure of the program office or the contractor's organization as the basis of a work breakdown structure.***

***Do not treat costs for meetings, travel, computer support, etc. as separate work breakdown structure elements.*** They are to be included with the work breakdown structure elements with which they are associated.

***Use actual system names and nomenclature. Generic terms are inappropriate in a work breakdown structure.*** The work breakdown structure elements should clearly indicate the character of the product to avoid semantic confusion. For example, if the Level 1 system is Fire Control, then the Level 2 item (prime mission product) is Fire Control Radar.

***Treat tooling as a functional cost, not a work breakdown structure element.*** Tooling (e.g., special test equipment, and factory support equipment like assembly tools, dies, jigs, fixtures, master forms, and handling equipment) should be included in the cost of the equipment being produced. If the tooling cannot be assigned to an identified subsystem or component, it should be included in the cost of integration, assembly, test, and checkout.

***Include software costs in the cost of the equipment.*** For example, when a software development facility is created to support the development of software, the effort associated with this element is considered part of the CSCI it supports or, if more than one CSCI is involved, the software effort should be included under integration, assembly, test, and checkout. Software developed to reside on specific equipment must be identified as a subset of that equipment.

### ***Additional Considerations***

Integration, assembly, test, and checkout includes production acceptance testing (including first article test) of R&D and production units but excludes all systems engineering/program management and system test and evaluation that are associated with the overall system. The appendices identify integration, assembly, test, and checkout separately, except for the aircraft system appendix (Appendix A). For aircraft systems, to be consistent with the historical data sets that are maintained on airframe, integration, assembly, test, and checkout is a sub-element of, and included in, the airframe work breakdown structure element.

This handbook does not identify level 3 elements for the systems engineering/program management work breakdown structure element. This allows the program manager and contractor flexibility to identify efforts that are important to the specific program. The definition given provides typical systems engineering or program management efforts.

System test and evaluation always separately identifies those tests performed in the development of a system, i.e., development test and evaluation, and those tests performed by the operational user, i.e., operational test and evaluation.

## **2.3 -- Solicitation and Proposal**

The work breakdown structure used for a solicitation is structured by selecting appropriate elements from the approved Program WBS. The contract line items, configuration items, contract statement of work tasks, contract specifications, and contractor responses will be expressed in terms of the work breakdown structure to enhance its effectiveness in satisfying the objectives of the particular acquisition. While the relationship of the Contract WBS elements to the statement of work tasks and the contract line items should be clearly traceable, there may not be a one-to-one relationship, nor is it required.

### **2.3.1 -- Specifications and Drawings**

The family of specifications and drawings resulting from the progressive steps of systems engineering will provide the basis for the Program WBS, the Contract WBS, and its extensions.



### **2.3.2 -- Contractor Management Control System**

The Contract WBS should serve as the framework for the contractor's management control system which will provide auditable and traceable summaries of internal data generated by its performance measurement procedures.

### **2.3.3 -- Acquisition Logistics**

The acquisition logistics element should be accommodated as indicated in the upper levels of the work breakdown structure. Areas for consideration include management and reporting; peculiar support equipment; and initial spares, support data, and training.

### **2.3.4 -- Planning, Programming and Budgeting System**

The Program WBS should be used whenever it is necessary to subdivide the program element data for the planning, programming and budgeting system.

### **2.3.5 -- Life-Cycle Cost**

Life-cycle cost is the total cost for the research and development, investment, operation and support, and disposition of a weapon or support system. It commences at the start of the conceptual stage and ends with the retirement or demilitarization of the system. The work breakdown structure requirements established are associated solely with those elements of research and development and investment that are applicable to all contracted efforts.

### **2.3.6 -- Procurement**

The following areas should be relatable to elements of the Program WBS: structure of work statements, contract work breakdown structures, contract line items, configuration items, technical and management reports, and government-furnished equipment.

### **2.3.7 -- Reporting**

All reporting requirements for the program should be consistent with the Program WBS.

## **2.4 -- Contract Statement of Work**

The work breakdown structure provides a framework for defining the technical objectives of the program. Together with the contract statement of work, the work breakdown structure aids in establishing an indentured data listing (specification tree), defining configuration items, and planning support tasks. The statement of work (SOW) is the document which describes in clear understandable terms what products are to be delivered or what services are to be performed by the contractor. Preparation of an effective statement of work requires a thorough understanding of the products and services needed to satisfy a particular requirement.

A statement of work expressed in explicit terms will facilitate effective contractor evaluation after contract award when the SOW becomes the standard for measuring contractor performance. Using a standardized work breakdown structure as a template when constructing the statement of

work for a system acquisition will help streamline the process. Use of the work breakdown structure will also facilitate a logical arrangement of the SOW elements, provide a convenient checklist to ensure all necessary elements of the program are addressed, and direct the contractor to meet specific contract reporting needs.

#### **2.4.1 -- Specification Tree**

A specification tree, developed by systems engineering, structures the performance parameters for the system or systems being developed. It subdivides the system into its component elements and identifies the performance objectives of the system and its elements. The performance characteristics are explicitly identified and quantified. Completed, the data listing represents a hierarchy of performance requirements for each component element of the system for which design responsibility is assigned. Because specifications may not be written for each product on the work breakdown structure, the specification tree may not match the work breakdown structure completely.

#### **2.4.2 -- Configuration Management**

Configuration management is the process of managing the technical configuration of items being developed whose requirements are specified and tracked. Configuration items are designated in the work breakdown structure, which may need to be extended beyond the third level to clearly define all elements subject to configuration management. Configuration management involves defining the baseline configuration for the configuration items, controlling the changes to that baseline, and accounting for all approved changes. In establishing the requirement for configuration management on a program, the program manager needs to designate which contract deliverables are subject to configuration management controls. A contract deliverable designated for configuration management is called a Configuration Item. For software, this item is called a Computer Software Configuration Item (CSCI).

### **2.5 -- Request for Proposal**

#### **2.5.1 -- Preparing a Preliminary Contract WBS**

The individual work breakdown structure elements from the Program WBS that apply to the contract will be selected by the DoD program manager for inclusion in a draft request for proposal (RFP). This is the initial time for open dialogue between the government and potential contractors. Innovative ideas or alternative solutions should be collected for inclusion in the final RFP. It will include a Contract WBS and the initial WBS Dictionary prepared by the program manager. The RFP should instruct potential contractors to extend the selected Contract WBS elements to define the complete contract scope.

#### **2.5.2 -- RFP Solicitation Requirements**

As previously stated, the contract line items, configuration items, contract work statement tasks, contract specifications, and contractor responses will be relatable to the work breakdown structure to enhance its effectiveness in satisfying the objectives of the particular acquisition. It is important to coordinate the development of the Program WBS and the CCDR plan with the

development of the statement of work so as to form consistency in document structure. When aggregated with the Program WBS, the extended Contract WBS will form a complete work breakdown structure of the program for use throughout the acquisition cycle.

### **2.5.3 -- Extended Contract Work Breakdown Structure**

Contractors extend the Contract WBS included in the RFP and submit the complete Contract WBS with their proposal. The proposal should be based on the work breakdown structure in the RFP, although contractors may suggest changes needed to meet an essential requirement of the RFP or to enhance the effectiveness of the Contract WBS in satisfying program objectives. Contractors are expected to extend the Contract WBS to the appropriate level -- the level which satisfies the critical visibility requirements and does not overburden the management control system.

## **2.6 -- Integrated Cost, Schedule, and Technical Performance Management**

Planning work by work breakdown structure elements serves as the basis for estimating and scheduling resource requirements. The work breakdown structure assists in managing cost, schedule and technical performance. By breaking the total product into successively smaller entities, management can ensure that all required products are identified in terms of cost, schedule and performance goals. Assigning performance budgets to work segments and identifying responsible units produces a time-phased plan against which actual performance can be measured. Corrective action can be taken when deviations from the plan are identified. This integrated approach to work planning also simplifies identifying the potential cost and schedule impacts of proposed technical changes.